

**AMENDMENTS TO THE CLAIMS:**

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (currently amended) A gas sensor measuring a given component content in a gas comprising:

a housing;

a sensing unit having a length disposed in said housing, said sensing unit having defined in a first end portion thereof a reference gas chamber to be filled with a reference gas used in providing a sensor signal through a lead which is employed in determining the given gas component content in the gas;

a first metallic cover installed on said housing to cover a second end portion of said sensing unit;

a second metallic cover installed on a periphery of said first metallic cover;

a first vent formed in said first metallic cover;

a second vent formed in said second metallic cover which communicates with said first vent to admit the reference gas into the reference gas chamber through a reference gas passage; and

an insulating member disposed in said first metallic cover, having formed therein a hole through which the lead passes to connect with said sensing unit, said insulating member being made of a cylindrical porcelain having an outer peripheral wall which is substantially circular in cross section and which defines the reference gas passage,

wherein said insulating member is arranged in alignment with said sensor unit and has a first end surface and a second end surface closer to said sensor unit, said insulating member having a groove formed in the outer peripheral wall which extends from the first vent to the first end surface to define a portion of the reference gas passage, and

wherein the first vent has a diameter  $R$  in the longitudinal direction of the gas sensor, and a distance between a point on a periphery of the first vent closest to the

second end surface of said insulating member and an upstream end of the groove facing the first vent is greater than or equal to  $R/3$ .

2. (currently amended) A gas sensor as set forth in claim 1, wherein said insulating member has ~~a first end surface and a second end surface opposed to the first end surface in a longitudinal direction of the gas sensor parallel to the length of said sensing unit, said insulating member having a through hole extending in a direction of the first end surface to the second end surface to define a portion of the reference gas passage.~~

Claim 3 (canceled).

4. (currently amended) A gas sensor as set forth in ~~claim 3~~ claim 1, wherein said insulating member has a small-diameter portion formed closer to the first end surface and a large-diameter portion continuing from the small-diameter portion, and wherein if a length of the small-diameter portion in a direction is defined as  $L1$ , a distance  $L2$  between the large-diameter portion and an upstream end of the groove facing the first vent lies within a range of  $L1/5$  to  $L1/2$ .

Claims 5 and 6 (canceled).

7. (currently amended) A gas sensor as set forth in ~~claim 3~~ claim 1, wherein if a plane tangent to a periphery of said insulating member is ~~defines~~ defined as  $P$ , a plane passing through the deepest point of the groove in parallel to the plane  $P$  is defined as  $P1$ , and a plane passing in parallel to the plane  $P$  through the center of the through hole formed in said insulating member is defined as  $P2$ , a distance  $S1$  between the planes  $P$  and  $P1$  is smaller than or equal to a distance  $S2$  between the planes  $P$  and  $P2$ .

Claim 8 (canceled).

9. (original) A gas sensor as set forth in claim 1, wherein if a width of the reference gas passages defined on the outer peripheral wall of said insulating member is defined as  $H1$ , and a diameter of said insulating member is defined as  $H2$ , a condition of  $H1 \leq H2/2^{1/2}$  is satisfied.

10. (original) A gas sensor as set forth in claim 1, wherein said insulating member has formed therein a plurality of lead holes through which leads pass to connect with said sensing unit, and wherein the reference gas passage is defined at a location where a line passing through a center of said insulating member between adjacent two of the lead holes intersects the outer peripheral wall of said insulating member.

Claims 11-16. (canceled).

17. (new) A gas sensor measuring a given component content in a gas comprising:

- a housing;

- a sensing unit having a length disposed in said housing, said sensing unit having defined in a first end portion thereof a reference gas chamber to be filled with a reference gas used in providing a sensor signal through a lead which is employed in determining the given gas component content in the gas;

- a first metallic cover installed on said housing to cover a second end portion of said sensing unit;

- a second metallic cover installed on a periphery of said first metallic cover;

- a first vent formed in said first metallic cover;

- a second vent formed in said second metallic cover which communicates with said first vent to admit the reference gas into the reference gas chamber through a reference gas passage; and

an insulating member disposed in said first metallic cover, having formed therein a hole through which the lead passes to connect with said sensing unit, said insulating member being made of a cylindrical porcelain having an outer peripheral wall which is substantially circular in cross section and which defines the reference gas passage,

wherein said insulating member is arranged in alignment with said sensor unit and has a first end surface and a second end surface closer to said sensor unit, said insulating member having a groove formed in the outer peripheral wall which extends from the first vent to the second end surface to define a portion of the reference gas passage, and

wherein if a plane tangent to a periphery of said insulating member is defined as  $P$ , a plane passing through the deepest point of the groove in parallel to the plane  $P$  is defined as  $P1$ , and a plane passing in parallel to the plane  $P$  through the center of the through hole formed in said insulating member is defined as  $P2$ , a distance  $S1$  between the planes  $P$  and  $P1$  is smaller than or equal to a distance  $S2$  between the planes  $P$  and  $P2$ .

18. (new) A gas sensor as set forth in claim 17, wherein said insulating member has a small-diameter portion formed closer to the first end surface and a large-diameter portion continuing from the small-diameter portion, and wherein if a length of the small-diameter portion in a direction is defined as  $L1$ , a distance  $L2$  between the large-diameter portion and an upstream end of the groove facing the first vent lies within a range of  $L1/5$  to  $L1/2$ .

19 (new) A gas sensor as set forth in claim 17, wherein if a width of the reference gas passages defined on the outer peripheral wall of said insulating member is defined as  $H1$ , and a diameter of said insulating member is defined as  $H2$ , a condition of  $H1 \leq H2/2^{1/2}$  is satisfied.

20. (new) A gas sensor as set forth in claim 17, wherein said insulating member has formed therein a plurality of lead holes through which leads pass to connect with said

HIBINO et al.  
Appl. No. 09/810,175  
December 2, 2003

sensing unit, and wherein the reference gas passage is defined at a location where a line passing through a center of said insulating member between adjacent two of the lead holes intersects the outer peripheral wall of said insulating member.